DRAFT
TECHNICAL MEMORANDUM:
PRELIMINARY CONTAMINANT OF POTENTIAL CONCERN SELECTION

PATRICK BAYOU SUPERFUND SITE
DEER PARK, TEXAS

Prepared for

U.S. Environmental Protection Agency
and the
Patrick Bayou Joint Defense Group

Prepared by

Anchor Environmental, L.L.C.
1011 DeSoto Street
Ocean Springs, Mississippi 39564

February 16, 2007

9015989

DRAFT

TECHNICAL MEMORANDUM:

PRELIMINARY CONTAMINANT OF POTENTIAL CONCERN SELECTION

PATRICK BAYOU SUPERFUND SITE

DEER PARK, TEXAS

Prepared for

U.S. Environmental Protection Agency

On Behalf of

Patrick Bayou Joint Defense Group

Prepared by

Anchor Environmental, L.L.C.

1011 DeSoto Street

Ocean Springs, Mississippi 39564

February 16, 2007

List of Tables

List of Figures

1 INTRODUCTION

This document describes the data evaluation and selection process used to determine the preliminary contaminants of potential concern (COPC) for the Patrick Bayou Superfund Site (Site) in Deer Park, Texas. The purpose of selecting preliminary COPC is to refine the preliminary COPC identified in the *Preliminary Site Characterization Report* (Anchor 2006a) and to support selection of target analytes for sediment samples and subsequent Remedial Investigation/Feasibility Study (RI/FS) tasks (e.g., risk assessment work plans). The COPC list was included in the *Hydrodynamic Field Data Collection and Contaminant Source Evaluation Work Plan* (Anchor 2006b) and was updated in the September 27, 2006 letter from de maximis to Mr. Philip Allen of the U.S. Environmental Protection Agency (USEPA). The updated COPC list was approved by EPA on September 27, 2006.

2 DATA EVALUATION

The following section summarizes the available data for sediment and surface water, the data selection and reduction process, and the data reliability for risk-based selection of preliminary COPC.

2.1 Data Availability, Selection, and Reduction

Anchor has completed a review of all previously collected data at the Site (Anchor 2006c). Historical data sets meeting the performance and acceptance criteria were considered suitable for the purposes of selection of preliminary COPC. More detailed data usability reviews of existing data may be performed during risk assessment or other RI activities as appropriate.

2.1.1 Sediment Chemistry

Forty-one sediment samples had previously been collected by others from the Site over the last ten years. Older data exist, but the performance and acceptance criteria established that data older than ten years would not be considered representative of current conditions. Good spatial coverage exists for surface sediment sampling locations. Sample locations for sediment are included in Figure 2-1. The evaluation of historical data in the RI database (Anchor 2006c) includes a summary of all sediment samples used in this evaluation.

For sediment, samples from depths of 0 to 10 centimeters (cm; .3 feet) were used preferentially since that depth range represents the most realistic exposures for sediment-dwelling organisms. Surface sample intervals exceeding that depth (up to 55 cm below surface) were included in the selection of preliminary COPC as they were considered relevant for exposure of ecological receptors. This is a conservative assumption intended to provide additional data and spatial coverage of the project area and to ensure that contaminants that may pose a potential risk to receptors are not eliminated.

At several locations, sediments were sampled more than once during the last ten years. In order to provide a conservative selection of COPC, all repeated measures at a station were evaluated in the screening process.

For total concentrations of polychlorinated biphenyl (PCB) Aroclors, polycyclic aromatic hydrocarbon (PAHs), chlordane, and DDT, summations were calculated and stored in the project database. For total values where at least one analyte included in the summation was detected, all detected values were included and non-detect values included at one-half the detection limit in the total. For total values where none of the analytes included in the summation was detected, the detection limit was set to the highest detection limit for an individual analyte and the data qualifier was set to non-detect ("U") for that total.

As preliminary screening tool, dioxin and furan congeners were assessed using the toxic equivalent (TEQ) approach described by van den Berg et al. (1998) according to the equation:

$$TEQ = \sum [\ PCDD_n xTEF_n\ ] + \sum\ [PCDF_p xTEF_p]$$

Where:
TEQ = Toxic equivalent (relative to 2,3,7,8-TCDD)
$PCDD_n$ = Polychlorinated dibenzo-p-dioxin congener concentration
$PCDF_P$ = Polychlorinated dibenzo-p-furan congener concentration
$TEF_{n,p}$ = Toxic equivalency factor for appropriate PCDD or PCDF

TEQ were calculated using fish, bird, and mammal total equivalency factor (TEF) and used for receptor groups as appropriate. One-half the detection limit was used in the TEQ calculation for PCDD or PCDF congeners that were not detected.

2.1.2 Surface Water

Fifty-nine surface water samples had previously been collected by others from the Site over the past ten years. Older data exist, but the performance and acceptance criteria established that data older than ten years would not be considered representative of current conditions. Surface water sample locations included in the selection of preliminary COPC is included in Figure 2-2. The evaluation of historical data in the RI

database (Anchor 2006c) includes a summary of all water samples used in this evaluation.

Several surface water sampling locations have been routinely monitored or sampled repeatedly during the last ten years. In order to provide a conservative selection of COPC in this preliminary screen, all repeated measures at a station are evaluated in the risk characterization. The total concentrations of PCBs, PAHs, DDT, and TEQ were calculated as described for sediment in the previous section.

2.2 Suitability of Data for Selection of Preliminary COPC

There are several factors that should be considered to assess the suitability and sufficiency of environmental data for risk assessment (USEPA 1989) that are also relevant for the purposes of selecting preliminary COPC. Of primary importance is the degree to which the data adequately represent site-related contamination, and the expected exposure of ecological receptors at the site. Other important considerations are data quality criteria goals, documentation, analytical methods/detection limits, and level of review associated with the data. Because data from several different investigations were available for Patrick Bayou, these factors were evaluated for each data set to determine whether it was reasonable to combine these data for use in the selection of preliminary COPC and subsequent RI/FS tasks.

2.2.1 Representativeness to Site-Related Contamination and Receptor Exposure

Previous environmental sampling events that have involved the collection of sediments from the Site primarily focused on site investigations in support of the NPL listing process (USEPA 2000) and the development of TMDLs (Parsons 2002 and 2004). The extensive spatial coverage and comprehensive analytical program of these sampling events indicates that available sediment chemistry data are likely representative of the general range of environmental conditions within Patrick Bayou. Sampling depths were generally within the biologically active zone of surface sediments (0 to 10 cm), with the exception of samples collected for the Hazard Ranking System Documentation Record (Texas Natural Resource Commission [TNRCC 2001b]), which were collected from depths up to 55 cm (1.8 feet). Although some samples may have been collected from

depths which are below the biologically active zone, they were considered representative of site-related contamination for selection of preliminary COPC.

Surface water sampling events and programs have included synoptic and routine sampling events. Although spatial coverage of the Site is not as extensive as sediment station locations, data are considered generally representative of the general range of conditions for Patrick Bayou.

2.2.2 QA/QC Results

All data sets used in the selection of preliminary COPC were validated by the original authors or by outside third parties, although documentation of the data validation or quality review is sometimes minimal. Data included in selection of preliminary COPC was reviewed according the performance and acceptance criteria described in Anchor 2006c.

3 SELECTION OF PRELIMINARY COPC APPROACH

This section describes the approach used to select preliminary COPC for sediment and surface water.

3.1 Selection of Risk-Based Ecological Sediment and Surface Water Benchmarks

Sediment benchmarks were obtained from *Update to Guidance for conducting ecological risk assessment at remediation sites in Texas* (Texas Council on Environmental Quality [TCEQ 2006]). The primary sediment benchmarks selected in this guidance were the Effects Range-Low (ERL) values in Long et al. (1995) and included values for metals, total DDT, PAHs, and total PCBs. The marine Threshold Effects Limit (TEL) from Smith et al. (1996) for chlordane, lindane, dieldrin, and phthalates were used. The Sum DDT, Sum DDE, and Sum DDE sediment benchmarks originate from Environment Canada (1997). Volatile organic chemical (VOC) benchmarks were derived in the guidance using the equilibrium partitioning modifications for volatiles suggested by Fuchsman (2003) and the TCEQ LC50-based surface water screening values. These benchmarks were selected to represent concentrations in sediment that are intended to be protective of benthic biota (TCEQ 2006). These benchmarks should be considered conservative values intended for screening of site constituents and do not represent site-specific risk-based levels or potential remediation goals. Site-specific risk-based levels will be developed in subsequent RI/FS risk assessment tasks. Selected sediment benchmark values are listed in Table 3-1.

The primary source for surface water benchmarks is the National Recommended Water Quality Criteria (NRWQC) Saltwater Criterion Continuous Concentration (CCC), which is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect (USEPA 2006). For chemicals that do not have a specified NRWQC CCC value, the TCEQ Ecological Benchmarks for Marine Water listed in *Update to Guidance for conducting ecological risk assessments at remediation sites in Texas* (TCEQ 2006) were considered. The primary sources of the TCEQ Ecological Benchmarks included State of Texas Water Quality Standard, derivation using an LC50 approach, TCEQ Waste Management Division chronic values, or USEPA Region 4 Water Management Division chronic screening values. Selected surface water benchmark values are listed in Table 3-2.

3.1.1 Selection of Potentially Bioaccumulative Preliminary COPC

Although wildlife receptors (e.g., birds and mammals) can be exposed to environmental contaminants through dermal contact with contaminated surface water or sediments (i.e., dermal exposure) or consumption of contaminated surface water or sediment (i.e., incidental ingestion), the bulk of their exposure (with a few exceptions) is associated with the consumption of contaminated prey items. This is particularly true for persistent and bioaccumulative COPC that may biomagnify up the food chain.

Potentially bioaccumlative chemicals detected in surface water and sediment were identified as preliminary COPC for wildlife based on the list provided in Table 3-3. This list is based on bioaccumulative chemicals identified in *Update to Guidance for conducting ecological risk assessments at remediation sites in Texas* (TCEQ 2006) and *Bioaccumulation and testing for the purpose of sediment quality assessment* (USEPA 2000).

3.2 Comparison of Ecological Benchmarks to Site Media Concentrations

For initial selection of preliminary COPC, the maximum measured media concentration for a chemical was compared to the medium-specific benchmarks described in the previous section. For chemicals not detected in any samples of a particular medium, the maximum reporting limit was compared to the appropriate medium-specific benchmark.

The following conservative methodology was used when selecting preliminary COPC during the initial screen:

- If a potentially bioaccumulative chemical (as listed in Table 3-3) was detected in sediment or surface water, it was retained as a preliminary COPC for that media.
- If the maximum detected concentration chemical exceeded the media-specific ecological benchmark, it was selected as a preliminary COPC for that media.
- If a chemical was detected but lacked a media-specific benchmark, that chemical was selected as a preliminary COPC for that media.
- If a chemical was not detected and the maximum detection limit exceeded the media-specific benchmark, that chemical was selected a preliminary COPC for that media.
- If a chemical was detected and the maximum concentration did not exceed the media-specific benchmark, it was not selected as a preliminary COPC. Alternatively,

if a chemical was not detected and the maximum detection limit was less than the media-specific ecological benchmark, it was not selected as a preliminary COPC.

- If a chemical was not detected and did not have a media-specific ecological benchmarks, that chemical was not selected as preliminary COPC for that media.

3.2.1 Refinement of Preliminary COPC

As described above, in the initial screen, highly conservative assumptions were used. As a result, some COPC that pose only negligible risk were likely retained. Therefore, to focus the selection of preliminary COPC on those chemicals in Site media that may have potential ecological risks, the assumptions used were further evaluated and other site-specific information was considered to refine the preliminary list of COPC based on comparison to the screening values.

Assumptions and methods used to refine the list of COPC are listed below, along with an explanation for each. These refinements were used to weigh the evidence of potential risk for each preliminary COPC identified for each medium. They are:

- Chemicals that were not detected but retained as COPC because their maximum reporting limit exceeded their respective screening values were considered for elimination as preliminary COPC. Additional information considered included the range of detection limits relative to the benchmark, the magnitude above the benchmark, and the presence of related chemicals above their respective benchmarks.
- The frequency of detection of chemicals was considered in the refinement of preliminary COPC. Chemicals that were infrequently detected may be artifacts in the data and not due to site related releases (USEPA 1989). Infrequently detected chemicals were considered candidates for elimination if 1) they were detected in 5 percent or less of samples from a given media; 2) they were not present in high concentrations (e.g., relative to available ecological benchmarks); and 3) there was no reason to believe they are site-related. Given the comprehensive spatial coverage of sampling in the project area, chemicals that met the criteria listed above were not considered to represent a risk to ecological receptors and eliminated as COPC.

- Refinement of COPC based on magnitude of detection may also be performed to streamline the overall risk assessment process (USEPA 2001). The magnitude of detection was considered in refinement of COPC. To support refinement of COPC based on magnitude of detection, maximum detected concentrations of chemicals in sediment without benchmarks were compared to sediment quality screening levels listed in Guidance for Assessing Texas Surface and Finished drinking water quality (TCEQ 2003). The screening levels represent 85th percentile concentrations in sediment of these chemicals from long-term Surface Water Quality Management (SWQM) data (Table 3-4). These values are used by the State of Texas to identify secondary water quality concerns in the 305(b) report. Although these values are not risk-based screening levels, chemicals detected above these values may be considered 'elevated' relative to similar Texas waterbodies and may warrant further consideration. Detected chemicals that did not have ecological benchmarks and exceeded the 85th percentile were assumed to be detected at a magnitude that may be a risk to ecological receptors. Chemicals without ecological benchmarks that were detected at concentrations below the 85th percentile were not considered of sufficient magnitude to warrant retention as preliminary COPC and were eliminated.

4 PRELIMINARY COPC ANALYSIS

4.1 Surface Sediment

4.1.1 Results

Table 4-1 summarizes the comparison of media concentrations to ecological benchmarks for chemicals in sediment. Sixty-nine chemicals analyzed in surface sediments were screened against available sediment benchmarks. Forty-four chemicals had maximum detected concentrations exceeding their respective ecological benchmark. Nine chemicals were not detected in surface sediments but had detection limits greater than their respective benchmarks. Ninety-six chemicals detected in sediment did not have sediment benchmarks. Fifty-four chemicals were not detected in sediments and did not have benchmarks; they are not considered preliminary COPC. Data summaries for these chemicals can be found in Anchor 2006c.

4.1.2 Selection of Preliminary COPC for Sediment

Preliminary COPC were initially identified using the methods described in Section 3.2. One hundred sixty-five chemicals detected in sediment either exceeded their respective benchmark or lacked a benchmark and were initially identified as preliminary COPC. It is unlikely that this list of preliminary COPC contribute equally to ecological risks; it is expected that a subset of these chemicals drive risk at the Site. Accordingly, chemicals evaluated in sediment and surface water were grouped into categories based primarily on their potential contribution to risks at the Site. Each group is discussed below.

4.1.2.1 Preliminary COPC Considered Potential Risk Drivers

Chemicals with detected concentrations that frequently exceeded available benchmarks, potentially bioaccumulate, or have a high magnitude of detection were considered to potentially drive risk to ecological receptors at the Site. In addition, chemicals similar to those identified as preliminary COPC based on the previous (e.g., PCB Aroclors) were considered potential risk drivers. Forty-four chemicals with maximum detected values exceeding their respective benchmarks were identified in sediment and are considered potential risk drivers for benthic invertebrates. This group includes metals, PAHs, PCBs, pesticides, and chlorinated benzenes. Twenty-eight other chemicals were identified as potential risk drivers based on their potential to bioaccumulate, magnitude of detection above the 85th

percentile, and/or their similarity to other risk drivers detected above their respective benchmark.

Preliminary COPC considered potential risk drivers and the basis for their selection is summarized in Table 4-2.

4.1.2.2 Chemicals Considered 'Second-tier' Preliminary COPC

Chemicals are frequently detected in sediment that lack adequate information (e.g., ecological benchmarks) to effectively evaluate their contribution to risk at this level of evaluation. Typically, these chemicals are retained for further evaluation as potential COPC. Chemicals retained and identified as 'second-tier' preliminary COPC in this analysis will be evaluated further in the RI/FS process. However, their impact on risk to receptors is expected to be low. It is hypothesized that, given the comprehensive list of preliminary COPC identified as potential risk drivers, addressing risk drivers will also adequately address risk due to second-tier preliminary COPC. That is, potential exposure pathways, modes of toxicity, spatial distribution, and environmental fate of second-tier preliminary COPC are adequately represented by preliminary COPC identified as potential risk drivers.

Many chemicals identified as second-tier COPC are either essential nutrients and/or may be related to background and are unrelated to site releases. These chemicals are identified as preliminary COPC but additional assessment of background concentrations is expected to indicate they pose negligible risk to Site receptors.

Additional Site characterization of second-tier COPC will not be performed at this time but may be addressed in subsequent work plans (e.g., risk assessment) if necessary. Preliminary COPC identified as second-tier COPC are listed in Table 4-2.

4.1.2.3 Chemicals Not Considered to be COPC

Given the number of samples evaluated in this analysis, chemicals that a) had maximum detected concentrations below the benchmark; b) were not detected; c) detected at low concentrations (relative to the 85th percentile); or d) were infrequently detected (less than 5 percent) likely represent negligible risk to

ecological receptors at the Site. These chemicals were not identified as preliminary COPC. These chemicals are listed in Table 4-2.

4.2 Surface Water

4.2.1 Results

Table 4-4 summarizes the comparison of media concentrations to ecological benchmarks for chemicals in surface water. Ten chemicals analyzed in surface water were screened against benchmarks. Thirty-three chemicals were detected in surface water that did not have benchmarks. Finally, 13 chemicals were not detected in surface water and did not have benchmarks.

4.2.2 Selection of Preliminary COPC for Surface Water

Three metals (copper, nickel, and silver) had detected concentrations exceeding ecological surface water benchmarks and were identified as preliminary COPC. Thirty-three chemicals without benchmarks were initially considered preliminary COPC as well. Preliminary surface water COPC are listed in Table 4-5.

4.2.2.1 Preliminary COPC Considered Potential Risk Drivers

Two metals, copper and nickel, had maximum detected values exceeding their respective benchmarks. They are considered potential risk drivers. Silver was not considered a COPC for reasons discussed in Section 4.2.2.3.

Although copper is identified as a preliminary COPC for surface water, its status as a risk driver is uncertain. Dissolved copper was listed as a source of impairment to surface water in Patrick Bayou on the 1994 303(d) list. Analyses of data collected through April 2001 indicate that dissolved copper no longer exceeded water quality standards due to control actions previously implemented, resulting in a delisting of Patrick Bayou for dissolved copper in 2002 (TCEQ 2007). Additional assessment and review of copper's status as a risk driver will be performed in subsequent RI/FS tasks (e.g., risk assessment work plan).

4.2.2.2 Chemicals Considered 'second-tier' Preliminary COPC

Several metals detected in surface water did not have available benchmarks. However, many of these metals are either essential nutrients and/or frequently related to background concentrations. These chemicals are identified as preliminary COPC, but additional assessment of background concentrations is expected to indicate they pose negligible risk to site receptors.

Several dioxin/furan congeners were detected in surface water samples. Surface water benchmarks for these chemicals are not available but they are considered potentially bioaccumulative for surface water. In addition, mercury and selenium were detected in surface water at concentrations below their surface water ecological benchmark values but are also considered bioaccumulative. Although these chemicals are considered bioaccumulative for surface water, limited site-specific data exists to assess the potential to bioaccumulate at the Site. Additional assessment and review of existing information may be necessary to determine if dioxin/furans, mercury, and/or selenium represent potential risk drivers for surface water exposure to ecological receptors. As such, these chemicals are listed as second-tier COPC and will be addressed in the risk assessment work plan.

4.2.2.3 Chemicals Not Considered to be COPC

Several metals detected in surface have maximum concentration below their respective surface water benchmarks and are not considered bioaccumulative in surface water. They are considered to pose negligible risk to ecological receptors. Silver was not considered a COPC due to low magnitude of detection (Hazard Quotient = 3.1) and infrequent detection above the benchmark (one of 42 samples).

5 CONCLUSIONS

5.1 Sediment

Seventy-two chemicals were identified as potential risk drivers due to their presence at concentrations exceeding their respective ecological benchmark, their relation to similar risk drivers (e.g., Aroclors), or potential to bioaccumulate. They include metals, PAHs, other semivolatile organic compounds (SVOC), pesticides, PCBs, dioxin/furans, and volatile organic compounds (VOC). These preliminary COPC were included in the *Hydrodynamic Field Data Collection and Contaminant Source Evaluation Work Plan* (Anchor 2006b) and updated in the de maximis letter to Mr. Philip Allen of USEPA on September 27, 2006. The need for additional assessment and characterization of second-tier preliminary COPC will be addressed in future work plans (i.e., risk assessment) for the RI/FS.

5.2 Surface Water

Sediment is considered the primary media driving potential risk at this Site. As such, characterization of surface water for preliminary COPC is not considered necessary at this time. The need for additional characterization of surface water preliminary COPC will be addressed in future work plans for the RI/FS.

6 REFERENCES

Anchor Environmental, L.L.C. (Anchor) 2006a. Preliminary Site Characterization Report. Patrick Bayou Superfund Site. Deer Park, Texas. Prepared for USEPA and Patrick Bayou Joint Defense Group.

Anchor 2006b. Draft Hydrodynamic Field Data Collection and Contaminant Source Evaluation Work Plan. Deer Park, Texas. Prepared for USEPA and Patrick Bayou Joint Defense Group.

Anchor . 2006c. Performance and acceptance criteria for existing data Patrick Bayou Superfund Site, Deer Park, Texas. Prepared for USEPA and Patrick Bayou Joint Defense Group.

Environment Canada. 1997. Canadian Sediment Quality Guidelines for DDTs, Interim Sediment Quality Guidelines (ISQG), Guidelines and Standards Division. January, 1998 Draft.

Fuchsman, P.C. 2003. Modification of the Equilibrium Partitioning Approach for Volatile Organic Compounds in Sediment. Environ Toxicol Chem. 22:1532-1534.

Long, E.R., D.D. MacDonald, S.L. Smith and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19(1):81-97.

Parsons et al. 2002. Assessment of sediment toxicity and quality in Patrick Bayou, Segment 1006, Harris County, Texas. Prepared for Patrick Bayou TMDL Lead Organization

Parsons et al. 2004. Assessment of sediment toxicity and quality in Patrick Bayou, Segment 1006, Harris County, Texas. Prepared for Patrick Bayou TMDL Lead Organization

Smith, S.L., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. J. Great Lakes Res. 22(3):624-638.

TCEQ. 2003. Guidance for Assessing Texas Surface and Finished Drinking Water Quality Data, 2004. Texas Commission on Environmental Quality. Office of Compliance and Enforcement. Austin, Texas.

TCEQ. 2006. Update to guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. Toxicology and Risk Assessment Section. Austin, Texas.

TCEQ. 2007. http://www.tceq.us/implementation/water/tmdl/18-patrickbayou.html#status. Retrieved in January, 2007.

TNRCC. 2000. EPA Superfund preliminary assessment/site inspection: Patrick Bayou. EPA ID TX0000605329. Mar-00. Deer Park, TX. Prepared in cooperation with USEPA.

TNRCC. 2001a. Guidance for conducting ecological risk assessments at remediation sites in Texas. RG-263. Toxicology and Risk Assessment Section. Austin, Texas.

TNRCC. 2001b. Hazard Ranking System Documentation Record. Patrick Bayou Site. Deer Park, Harris County, Texas. TX0000605329. Prepared in cooperation with USEPA.

TNRCC and USEPA. 1996. Contaminant assessment of Patrick Bayou. Prepared by L Broach and P Crocker.

USEPA. 1989. Risk assessment guidance for Superfund, Volume I – Human health evaluation manual, Part A, Interim Final. EPA/540/1-89/002. Office of Emergency and Remedial Response. Washington DC.

USEPA. 2000. Bioaccumulation testing and interpretation for the purpose of sediment quality assessment. Status and needs. EPA-823-R-00-001. Bioaccumulation Work Group. Washington DC.

USEPA. 2001. ECO Update: The role of screening-level risk assessments and refining contaminants of concern in baseline ecological risk assessments. Publication 9345.0-14. Office of Solid Waste and Emergency Response. Washington, DC.

USEPA. 2006. National recommended water quality criteria. Office of Water. Office of Science and Technology (4304T).

Van den Berg M, Birnbaum L, Bosveld AT, Brunstrom B, Cook P, Feeley M, Giesy JP, Hanberg A, Hasegawa R, Kennedy SW, Kubiak T, Larsen JC, van Leeuwen FX, Liem AK, Nolt C, Peterson RE, Poellinger L, Safe S, Schrenk D, Tillitt D, Tysklind M, Younes M, Waern F, Zacharewski T.1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environmental Health Perspectives. Dec;106(12):775-92.

TABLES

Table 3-1
Sediment Ecological Benchmarks

Chemical Name	CASRN	Marine Benchmark Value
Inorganics (mg/kg dry wt.)		
Arsenic	7440-38-2	8.20
Cadmium	7440-43-9	1.20
Chromium	7440-47-3	81
Copper	7440-50-8	34
Lead	7439-92-1	46.7
Mercury	7439-97-6	0.15
Nickel	7440-02-0	20.9
Silver	7440-22-4	1.0
Zinc	7440-66-6	150
Pesticide/PCB (µg/kg dry wt.)		
Aroclor 1016[a]	12674-11-2	22.7
Aroclor 1221[a]	11104-28-2	22.7
Aroclor 1232[a]	11141-16-5	22.7
Aroclor 1242[a]	53469-21-9	22.7
Aroclor 1248[a]	12672-29-6	22.7
Aroclor 1254[a]	11097-69-1	22.7
Aroclor 1260[a]	11096-82-5	22.7
Total PCBs	NA	22.7
Dieldrin	60-57-1	0.715
gamma-BHC (Lindane)	58-89-9	0.32
alpha-Chlordane[b]	5103-71-9	2.26
gamma-Chlordane[b]	5566-34-7	2.26
Total Chlordane	NA	2.26
Sum of DDD[c]	NA	1.22
Sum of DDE[c]	NA	2.07
Sum of DDT[c]	NA	1.19
Total DDT	NA	1.58
Polycyclic Aromatic Hydrocarbons (µg/kg dry wt.)d		
2-Methylnaphthalene	91-57-6	70
Acenaphthene	83-32-9	16
Acenaphthylene	208-96-8	44
Anthracene	120-12-7	85.3
Benzo(a)anthracene	56-55-3	260
Benzo(a)pyrene	50-32-8	430
Chrysene	218-01-9	384
Dibenzo(a,h)anthracene	53-70-3	63.4
Fluoranthene	206-44-0	600
Fluorene	86-73-7	19
Naphthalene	91-20-3	160
Phenanthrene	85-01-8	240
Pyrene	129-00-0	665
High Molecular Weight PAHs	NA	1700
Low Molecular Weight PAHs	NA	552
Total PAHs	NA	4020
Phthalates (µg/kg dry wt.)		
bis(2-Ethylhexyl)phthalate	117-81-7	182
Volatiles (µg/kg dry wt.)		
Acetone	67-64-1	167230
Acrylonitrile	107-13-1	170

Table 3-1
Sediment Ecological Benchmarks

Chemical Name	CASRN	Marine Benchmark Value
Benzene	71-43-2	140
Carbon tetrachloride	56-23-5	3670
Chlorobenzene	108-90-7	290
Chloroform	67-66-3	4300
Chloromethane	74-87-3	8740
1,2-dichlorobenzene	95-50-1	740
1,3-dichlorobenzene	541-73-1	320
1,4-dichlorobenzene	106-46-7	700
1,2-dichloroethane	107-06-2	4300
1,1-dichloroethene	75-35-4	15410
1,2-dichloropropane	78-87-5	2820
1,3-dichloropropene	542-75-6	40
Ethylbenzene	100-41-4	650
Hexachlorobutadiene	87-68-3	20
Hexachloroethane	67-72-1	180
4-methyl-2-pentanone	108-10-1	45340
Methyl bromide	74-83-9	420
Methylene chloride	75-09-2	3820
Nitrobenzene	98-95-3	130
Styrene	100-42-5	3720
1,1,2,2-tetrachloroethane	79-34-5	610
Tetrachloroethene	127-18-4	3100
Toluene	108-88-3	940
Bromoform	75-25-2	1780
1,2,4-trichlorobenzene	120-82-1	390
1,1,1-trichloroethane	71-55-6	300
Trichloroethene	79-01-6	1470
1,2,4-trimethylbenzene	95-63-6	2160
Xylenes	1330-20-7	2540

Notes

Includes only benchmarks for chemicals included in historical data sampling programs

a - Total PCB benchmark used as a surrogate for individual Aroclor compounds

b - Total chlordane benchmark used as surrogate for individual chlordane compounds

c - Includes sum of p-,p'- and o-,p'- isomers

d - PAH compounds are compared to individual benchmark values as well as those for low molecular weight PAHs, high molecular weight PAHs, and total PAHs

Source: TNRCC 2001a

Table 3-2
Surface Water Ecological Benchmarks

Chemical	CASRN	Benchmark Value	Source	Notes
Inorganic (µg/L)				
Arsenic	7440-38-2	78	1	A
Cadmium	7440-43-9	10	1	A
Chromium	7440-47-3	50	1	A
Copper	7440-50-8	3.1	1	A
Lead	7439-92-1	8.1	1	A
Mercury	7439-97-6	0.94	1	A
Nickel	7440-02-0	8.2	2	A
Selenium	7782-49-2	71	1	A
Silver	7440-22-4	0.19	2	A
Zinc	7440-66-6	81	1	A

Notes:

A - dissolved fraction in water

Includes only benchmarks for chemicals included in historical data sampling programs

Sources:

1 - USEPA 2006

2 - TNRCC 2001a

Table 3-3
Potentially Bioaccumulative Chemicals List for Sediment and Surface Water

Chemical	CASRN	Source
Sediment		
Dioxin/furan congeners		
1,2,3,4,6,7,8-HpCDD	35822-46-9	1
1,2,3,4,6,7,8-HpCDF	67562-39-4	1
1,2,3,4,7,8,9-HpCDF	55673-89-7	1
1,2,3,4,7,8-HxCDD	39227-28-6	1
1,2,3,4,7,8-HxCDF	70648-26-9	1
1,2,3,6,7,8-HxCDD	57653-85-7	1
1,2,3,6,7,8-HxCDF	57117-44-9	1
1,2,3,7,8,9-HxCDD	19408-74-3	1
1,2,3,7,8,9-HxCDF	72918-21-9	1
1,2,3,7,8-PeCDD	40321-76-4	1
1,2,3,7,8-PeCDF	57117-41-6	1
2,3,4,6,7,8-HxCDF	60851-34-5	1
2,3,4,7,8-PeCDF	57117-31-4	1
2,3,7,8-TCDD	1746-01-6	1
2,3,7,8-TCDF	51207-31-9	1
OCDD	3268-87-9	1
OCDF	39001-02-0	1
Total TEQ	NA	1
Inorganics		
Arsenic	7440-38-2	1
Cadmium	7440-43-9	1
Chromium	7440-47-3	1
Copper	7440-50-8	1
Lead	7439-92-1	1
Mercury	7439-97-6	1
Nickel	7440-02-0	1
Selenium	7782-49-2	1
Zinc	7440-66-6	1
Pesticide/PCBs		
Aroclor 1016	12674-11-2	1
Aroclor 1221	11104-28-2	1
Aroclor 1232	11141-16-5	1
Aroclor 1242	53469-21-9	1
Aroclor 1248	12672-29-6	1
Aroclor 1254	11097-69-1	1
Aroclor 1260	11096-82-5	1
Total PCBs	NA	1
Aldrin	309-00-2	1
alpha-BHC	319-84-6	1
alpha-Chlordane[a]	5103-71-9	1
beta-BHC	319-85-7	1
delta-BHC	319-86-8	1
Dieldrin	60-57-1	1
Endosulfan I	959-98-8	1
Endosulfan II	33213-65-9	1
Endrin	72-20-8	1
gamma-BHC (Lindane)	58-89-9	1
gamma-Chlordane[a]	5566-34-7	1

Table 3-3
Potentially Bioaccumulative Chemicals List for Sediment and Surface Water

	Chemical	CASRN	Source
	Heptachlor	76-44-8	1
	Heptachlor Epoxide	1024-57-3	1
	Methoxychlor	72-43-5	1
	Sum of DDD[b]	DDD-SUM	1
	Sum of DDE[b]	DDE-SUM	1
	Sum of DDT[b]	DDT-SUM	1
	Total Chlordane	NA	1
	Total DDT	NA	1
	Toxaphene	8001-35-2	1
	Semivolatile and volatile organic compounds		
	4-Bromophenyl-phenylether	101-55-3	1
	4-Chlorophenyl-phenylether	7005-72-3	1
	Acenaphthene	83-32-9	1
	Acenaphthylene	208-96-8	1
	Anthracene	120-12-7	1
	Benzo(a)anthracene	56-55-3	1
	Benzo(a)pyrene	50-32-8	1
	Benzo(b)fluoranthene	205-99-2	1
	Benzo(g,h,i)perylene	191-24-2	1
	Benzo(k)fluoranthene	207-08-9	1
	Chrysene	218-01-9	1
	Dibenzo(a,h)anthracene	53-70-3	1
	Dibenzofuran	132-64-9	1
	Fluoranthene	206-44-0	1
	Fluorene	86-73-7	1
	Hexachlorobenzene	118-74-1	1
	Hexachlorobutadiene	87-68-3	1
	Hexachlorocyclopentadiene	77-47-4	1
	Hexachloroethane	67-72-1	1
	Indeno(1,2,3-cd)pyrene	193-39-5	1
	Phenanthrene	85-01-8	1
	Pyrene	129-00-0	1
	High Molecular Weight PAHs	NA	1
	Low Molecular Weight PAHs	NA	1
	Total PAHs	NA	1
	1,2,4-Trichlorobenzene	120-82-1	1
	1,2-Dichlorobenzene	95-50-1	1
	1,3-Dichlorobenzene	541-73-1	1
	1,4-Dichlorobenzene	106-46-7	1
Surface Water			
	Dioxin/furan congeners		
	1,2,3,4,6,7,8-HpCDD	35822-46-9	2
	1,2,3,4,6,7,8-HpCDF	67562-39-4	2
	1,2,3,4,7,8,9-HpCDF	55673-89-7	2
	1,2,3,4,7,8-HxCDD	39227-28-6	2
	1,2,3,4,7,8-HxCDF	70648-26-9	2
	1,2,3,6,7,8-HxCDD	57653-85-7	2
	1,2,3,6,7,8-HxCDF	57117-44-9	2
	1,2,3,7,8,9-HxCDD	19408-74-3	2
	1,2,3,7,8,9-HxCDF	72918-21-9	2

Table 3-3
Potentially Bioaccumulative Chemicals List for Sediment and Surface Water

	Chemical	CASRN	Source
	1,2,3,7,8-PeCDD	40321-76-4	2
	1,2,3,7,8-PeCDF	57117-41-6	2
	2,3,4,6,7,8-HxCDF	60851-34-5	2
	2,3,4,7,8-PeCDF	57117-31-4	2
	2,3,7,8-TCDD	1746-01-6	2
	2,3,7,8-TCDF	51207-31-9	2
	OCDD	3268-87-9	2
	OCDF	39001-02-0	2
	Total TEQ	NA	2
	Inorganics		
	Mercury	7439-97-6	2
	Selenium	7782-49-2	2

Note:

Includes only benchmarks for chemicals included in historical data sampling programs

NA - Not applicable

a - Total chlordane benchmark used as surrogate for individual chlordane compounds

b - Includes sum of p-,p'- and o-,p'- isomers

Sources:

1 - USEPA 2000

2 - TNRCC 2001a

Table 3-4
85th Percentile Sediment Concentrations in TCEQ SWQM Database

Group	Chemical	Units	85th percentile[a]
Pesticides	Aldrin	µg/kg	21
Pesticides	Endrin	µg/kg	28.7
Pesticides	Heptachlor	µg/kg	17.5
Pesticides	Heptachlor Epoxide	µg/kg	50
Pesticides	Methoxychlor	µg/kg	75
SVOCs	1,2-Diphenylhydrazine	µg/kg	1709
SVOCs	2,4-Dimethylphenol	µg/kg	1950
SVOCs	2,4-Dinitrotoluene	µg/kg	1800
SVOCs	2,6-Dinitrotoluene	µg/kg	1709
SVOCs	2-Chloronaphthalene	µg/kg	1970
SVOCs	3,3'-Dichlorobenzidine	µg/kg	2900
SVOCs	4-Bromophenyl-phenylether	µg/kg	1800
SVOCs	4-Chlorophenyl-phenylether	µg/kg	1800
SVOCs	Benzidine	µg/kg	4600
SVOCs	Benzo(b)fluoranthene	µg/kg	1800
SVOCs	Benzo(g,h,i)perylene	µg/kg	1800
SVOCs	Benzo(k)fluoranthene	µg/kg	1800
SVOCs	bis(2-Chloroethoxy)methane	µg/kg	1709
SVOCs	bis(2-Chloroethyl)ether	µg/kg	1709
SVOCs	bis(2-Chloroisopropyl)ether	µg/kg	1709
SVOCs	Butylbenzylphthalate	µg/kg	1800
SVOCs	Chrysene	µg/kg	1800
SVOCs	Dibenzo(a,h)anthracene	µg/kg	1800
SVOCs	Diethylphthalate	µg/kg	1800
SVOCs	Dimethylphthalate	µg/kg	1709
SVOCs	Di-n-butylphthalate	µg/kg	2800
SVOCs	Di-n-octylphthalate	µg/kg	1800
SVOCs	Hexachlorobenzene	µg/kg	753
SVOCs	Indeno(1,2,3-cd)pyrene	µg/kg	1800
SVOCs	n-Nitrosodiphenylamine	µg/kg	1350
SVOCs	Pentachlorophenol	µg/kg	3850
SVOCs	Phenol	µg/kg	1950
VOCs	1,1-Dichloroethane	µg/kg	300
VOCs	Chloroethane	µg/kg	750
VOCs	Vinyl chloride	µg/kg	750

Note:

Includes only chemicals in project database that were detected and lack ecological sediment benchmarks

a - 85th percentile of observations in SWQM portion of TRACS database. Taken from TCEQ 2003.

Table 4-1
Summary of Sediment Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
Benchmark = YES													
Metals	Arsenic	mg/kg	41	2	164	41	100	11.71			0	8.2	TRUE
Metals	Cadmium	mg/kg	41	0.0872	1.84	39	95.12	0.78	0.13	0.135	2	1.2	TRUE
Metals	Chromium	mg/kg	41	9.8	497	41	100	121.54	--	--	0	81	TRUE
Metals	Copper	mg/kg	41	10.1	271	41	100	68.75	--	--	0	34	TRUE
Metals	Lead	mg/kg	41	13.5	260	41	100	64.92	--	--	0	46.7	TRUE
Metals	Mercury	mg/kg	41	0.0549	41.5	41	100	7.01	--	--	0	0.15	TRUE
Metals	Nickel	mg/kg	41	7.4	156	41	100	33.58	--	--	0	20.9	TRUE
Metals	Silver	mg/kg	41	0.129	62.8	31	75.61	2.62	0	0.215	10	1	TRUE
Metals	Zinc	mg/kg	41	47.6	1750	41	100	373.49	--	--	0	150	TRUE
PCBs	Aroclor 1016	µg/kg	16	--	--	0	0	--	43	6000	16	22.7	TRUE *
PCBs	Aroclor 1221	µg/kg	16	--	--	0	0	--	50	12000	16	22.7	TRUE *
PCBs	Aroclor 1232	µg/kg	16	--	--	0	0	--	43	6000	16	22.7	TRUE *
PCBs	Aroclor 1242	µg/kg	16	--	--	0	0	--	43	6000	16	22.7	TRUE *
PCBs	Aroclor 1248	µg/kg	16	160	300000	14	87.5	26037.14	43	58	2	22.7	TRUE
PCBs	Aroclor 1254	µg/kg	16	--	--	0	0	--	43	6000	16	22.7	TRUE *
PCBs	Aroclor 1260	µg/kg	16	250	3400	7	43.75	1505.71	43	6000	9	22.7	TRUE
PCBs	Total PCBs (U=1/2; Max RL)	µg/kg	16	347.5	321000	14	87.5	28918.79	87	120	2	22.7	TRUE
Pesticides	4,4'-DDD	µg/kg	38	0.073	62	9	23.68	9.68	4.3	600	29	1.22	TRUE
Pesticides	4,4'-DDE	µg/kg	38	0.178	20.5	19	50	6.11	3	600	19	2.07	TRUE
Pesticides	4,4'-DDT	µg/kg	38	0.038	5.65	7	18.42	1.39	4.3	600	31	1.19	TRUE
Pesticides	alpha-Chlordane	µg/kg	38	0.112	5.5	14	36.84	1.56	2.2	310	24	2.26	TRUE
Pesticides	Dieldrin	µg/kg	16	--	--	0	0	--	4.3	600	16	72	TRUE *
Pesticides	gamma-BHC (Lindane)	µg/kg	16	0.86	10	2	12.5	5.43	2.2	310	14	0.32	TRUE
Pesticides	gamma-Chlordane	µg/kg	38	0.055	0.964	8	21.05	0.37	2.2	310	30	2.26	FALSE
Pesticides	Total Chlordane (a&g; U=1/2; Max RL)	µg/kg	38	0.29	22.5	15	39.47	9.55	2.2	310	23	2.26	TRUE
Pesticides	Total DDT (U=1/2; Max RL)	µg/kg	38	0.44	81	24	63.16	36.1	4.3	600	14	1.58	TRUE
SVOCs	Hexachlorobutadiene	µg/kg	41	35	30000	24	58.54	7924.65	20.5	25000	17	20	TRUE
SVOCs	Hexachloroethane	µg/kg	41	21.3	7100	20	48.78	1311.92	22.3	25000	21	180	TRUE
SVOCs	2-Methylnaphthalene	µg/kg	41	29.1	28000	33	80.49	2721.85	10.5	18000	8	70	TRUE
SVOCs	Acenaphthene	µg/kg	41	2.47	20000	40	97.56	2775.28	18000	18000	1	16	TRUE
SVOCs	Acenaphthylene	µg/kg	41	44.3	31000	35	85.37	3690.47	385	18000	6	44	TRUE
SVOCs	Anthracene	µg/kg	41	23.2	14000	38	92.68	1722.77	530	18000	3	85.3	TRUE
SVOCs	Benzo(a)anthracene	µg/kg	41	37	4400	35	85.37	1198.77	392	18000	6	260	TRUE
SVOCs	Benzo(a)pyrene	µg/kg	40	140	4400	31	77.5	1559.11	385	18000	10	430	TRUE
SVOCs	bis(2-Ethylhexyl)phthalate	µg/kg	40	157.8	14400	29	72.5	2855.96	392	16000	12	182	TRUE
SVOCs	Chrysene	µg/kg	40	60	6150	39	97.5	1680.53	18000	18000	2	384	TRUE
SVOCs	Dibenzo(a,h)anthracene	µg/kg	41	41.1	495.9	19	46.34	214.98	50.5	25000	22	63.4	TRUE
SVOCs	Fluoranthene	µg/kg	41	76.4	40000	40	97.56	5357.3	18000	18000	1	600	TRUE
SVOCs	Fluorene	µg/kg	41	18.1	21000	39	95.12	1989.24	530	18000	2	19	TRUE
SVOCs	Naphthalene	µg/kg	41	35.9	41500	32	78.05	2743.46	121	18000	9	160	TRUE
SVOCs	Phenanthrene	µg/kg	41	50	46800	40	97.56	6828.71	18000	18000	1	240	TRUE
SVOCs	Pyrene	µg/kg	41	58	98000	41	100	10808.15	--	--	0	665	TRUE
SVOCs	Total HPAHs (U=1/2; Max RL)	µg/kg	41	955	176300	41	100	29880.41	--	--	0	1700	TRUE
SVOCs	Total LPAHs (U=1/2; Max RL)	µg/kg	41	218	164500	40	97.56	19310.7	18000	18000	1	552	TRUE
SVOCs	Total PAHs (U=1/2; Max RL)	µg/kg	40	2549	263100	40	100	51282.5	--	--	0	4020	TRUE
VOCs	1,1,1-Trichloroethane	µg/kg	41	--	--	0	0	--	2	1100	41	300	TRUE *
VOCs	1,1,2,2-Tetrachloroethane	µg/kg	41	--	--	0	0	--	1.78	1100	41	610	TRUE *
VOCs	1,1-Dichloroethene	µg/kg	41	--	--	0	0	--	1.63	1100	41	15410	FALSE *
VOCs	1,2,4-Trimethylbenzene	µg/kg	21	51.6	51.6	1	4.76	51.6	5	100	20	2160	FALSE
VOCs	1,2-Dichlorobenzene	µg/kg	40	6.89	348	2	5	177.44	6	1100	38	740	FALSE

Table 4-1
Summary of Sediment Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
VOCs	1,2-Dichloroethane	µg/kg	41	--	--	0	0	--	2.63	1100	41	4300	FALSE *
VOCs	1,2-Dichloropropane	µg/kg	41	--	--	0	0	--	1.58	1100	41	2820	FALSE *
VOCs	1,3-Dichlorobenzene	µg/kg	41	2	33000	29	70.73	2454.13	5	408	12	320	TRUE
VOCs	1,4-Dichlorobenzene	µg/kg	41	2	4980	25	60.98	684.48	6	408	16	700	TRUE
VOCs	4-Methyl-2-pentanone (MIBK)	µg/kg	38	--	--	0	0	--	13	1100	38	45340	FALSE *
VOCs	Acetone	µg/kg	38	205	205	1	2.63	205	13	2000	37	167230	FALSE
VOCs	Acrylonitrile	µg/kg	25	--	--	0	0	--	5.9	1000	25	170	TRUE *
VOCs	Benzene	µg/kg	41	2	494	15	36.59	160.01	3.65	100	26	140	TRUE
VOCs	Bromoform	µg/kg	41	--	--	0	0	--	1.24	1100	41	1780	FALSE *
VOCs	Carbon tetrachloride	µg/kg	41	--	--	0	0	--	1.74	1100	41	3670	FALSE *
VOCs	Chlorobenzene	µg/kg	41	1	2200	17	41.46	309.25	1.88	100	24	290	TRUE
VOCs	Chloroform	µg/kg	41	1	1	1	2.44	1	1.64	1100	40	4300	FALSE
VOCs	Chloromethane	µg/kg	41	--	--	0	0	--	1.99	1100	41	8740	FALSE *
VOCs	Ethylbenzene	µg/kg	41	4	650	12	29.27	172.92	1.8	100	29	650	FALSE
VOCs	Styrene	µg/kg	38	10	86	3	7.89	39.67	5	1100	35	3720	FALSE
VOCs	Tetrachloroethene	µg/kg	38	13	13	1	2.63	13	5	1100	37	3100	FALSE
VOCs	Toluene	µg/kg	38	2	950	11	28.95	181.89	5	100	27	940	TRUE
VOCs	Total xylene	µg/kg	38	2	3500	15	39.47	575.67	5	100	23	2540	TRUE
VOCs	Trichloroethene	µg/kg	25	--	--	0	0	--	1.9	100	25	1470	FALSE *
Chemical detected = YES Benchmark = NO													
Conventionals	Ammonia	mg/kg	3	39.7	362	3	100	178.57			0	NA	NA
Conventionals	Cyanide	mg/kg	16	0.26	1.01	7	43.75	0.56	0.03	0.08	9	NA	NA
Diox/Fur	1,2,3,4,6,7,8-HpCDD	ng/kg	22	15.6	1835	22	100	306.51			0	NA	NA
Diox/Fur	1,2,3,4,6,7,8-HpCDF	ng/kg	22	14.8	1763	22	100	432.08			0	NA	NA
Diox/Fur	1,2,3,4,7,8,9-HpCDF	ng/kg	22	1.41	190	22	100	56.9			0	NA	NA
Diox/Fur	1,2,3,4,7,8-HxCDD	ng/kg	22	1.34	20.1	15	68.18	5.83	0.52	7.24	7	NA	NA
Diox/Fur	1,2,3,4,7,8-HxCDF	ng/kg	22	7.99	898	22	100	191.33			0	NA	NA
Diox/Fur	1,2,3,6,7,8-HxCDD	ng/kg	22	1.75	67	20	90.91	13.39	0.46	2.95	2	NA	NA
Diox/Fur	1,2,3,6,7,8-HxCDF	ng/kg	22	1.95	227	22	100	58.19			0	NA	NA
Diox/Fur	1,2,3,7,8,9-HxCDD	ng/kg	22	2.69	36.5	17	77.27	12.68	0.52	3.07	5	NA	NA
Diox/Fur	1,2,3,7,8,9-HxCDF	ng/kg	22	1.02	28.1	14	63.64	8.52	0.36	7.27	8	NA	NA
Diox/Fur	1,2,3,7,8-PeCDD	ng/kg	22	0.829	9.75	6	27.27	3.53	0.21	5.81	16	NA	NA
Diox/Fur	1,2,3,7,8-PeCDF	ng/kg	22	1.42	560	22	100	108.82			0	NA	NA
Diox/Fur	2,3,4,6,7,8-HxCDF	ng/kg	22	0.526	42.7	22	100	12.71			0	NA	NA
Diox/Fur	2,3,4,7,8-PeCDF	ng/kg	22	1.54	156	21	95.45	42.3	1.33	1.33	1	NA	NA
Diox/Fur	2,3,7,8-TCDD	ng/kg	22	2.04	108	14	63.64	17.81	0.43	0.91	8	NA	NA
Diox/Fur	2,3,7,8-TCDF	ng/kg	22	1.23	424	22	100	66.94			0	NA	NA
Diox/Fur	OCDD	ng/kg	22	358	20048	22	100	3555			0	NA	NA
Diox/Fur	OCDF	ng/kg	22	78.3	92390	22	100	11446.1			0	NA	NA
Diox/Fur	Total D/F TEQ-Bird (U=1/2; max RL)	ng/kg	22	5.68	783	22	100	166			0	NA	NA
Diox/Fur	Total D/F TEQ-Fish (U=1/2; max RL)	ng/kg	22	2.73	312	22	100	77.91			0	NA	NA
Diox/Fur	Total D/F TEQ-Mammal (U=1/2; max RL)	ng/kg	22	2.97	343	22	100	84.21			0	NA	NA
Metals	Aluminum	mg/kg	16	3690	10400	16	100	6623.75			0	NA	NA
Metals	Antimony	mg/kg	16	0.92	1.2	3	18.75	1.03	0.26	1.3	13	NA	NA
Metals	Barium	mg/kg	41	53.6	23500	41	100	889.01			0	NA	NA
Metals	Beryllium	mg/kg	16	0.37	1	13	81.25	0.64	0.195	0.345	3	NA	NA
Metals	Calcium	mg/kg	16	4730	232000	16	100	55443.75			0	NA	NA
Metals	Cobalt	mg/kg	16	2.6	14.2	16	100	7.98			0	NA	NA
Metals	Iron	mg/kg	41	4940	44600	41	100	14389.51			0	NA	NA
Metals	Magnesium	mg/kg	16	1380	8340	16	100	3290.62			0	NA	NA
Metals	Manganese	mg/kg	16	72.6	3500	16	100	381.88			0	NA	NA

Table 4-1
Summary of Sediment Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
Metals	Potassium	mg/kg	16	369	1630	16	100	994.5			0	NA	NA
Metals	Selenium	mg/kg	41	0.344	2.56	25	60.98	0.87	0	1.05	16	NA	NA
Metals	Sodium	mg/kg	16	1840	12500	16	100	5278.75			0	NA	NA
Metals	Thallium	mg/kg	16	1	1.1	2	12.5	1.05	0	1.4	14	NA	NA
Metals	Vanadium	mg/kg	16	10.1	87.7	16	100	20.61			0	NA	NA
Pesticides	Aldrin	µg/kg	16	170	8200	3	18.75	2866.67	2.2	390	13	NA	NA
Pesticides	beta-BHC	µg/kg	16	6.9	7.6	2	12.5	7.25	2.2	310	14	NA	NA
Pesticides	delta-BHC	µg/kg	16	16	16	1	6.25	16	2.2	310	15	NA	NA
Pesticides	Endosulfan I	µg/kg	16	0.99	270	9	56.25	47.11	2.2	35	7	NA	NA
Pesticides	Endosulfan II	µg/kg	16	2.9	150	5	31.25	36.44	4.3	62000	11	NA	NA
Pesticides	Endrin	µg/kg	16	1.9	1000	9	56.25	174.99	4.3	75	7	NA	NA
Pesticides	Endrin ketone	µg/kg	16	2	100	11	68.75	21.01	4.3	13	5	NA	NA
Pesticides	Heptachlor	µg/kg	16	1.4	1100	4	25	281.33	2.2	39	12	NA	NA
Pesticides	Heptachlor Epoxide	µg/kg	38	0.278	1.26	4	10.53	0.61	2.2	310	34	NA	NA
Pesticides	Methoxychlor	µg/kg	16	9.5	290	5	31.25	78.9	22	390	11	NA	NA
SVOCs	1,1'-Biphenyl	µg/kg	16	48	12000	8	50	2535.75	520	18000	8	NA	NA
SVOCs	2,4-Dinitrotoluene	µg/kg	41	2.13	204	6	14.63	83.22	18.9	25000	35	NA	NA
SVOCs	2,6-Dinitrotoluene	µg/kg	41	90.2	23000	9	21.95	2775.13	19.8	25000	32	NA	NA
SVOCs	2-Chloronaphthalene	µg/kg	41	2.24	47.2	7	17.07	14.76	10.8	25000	34	NA	NA
SVOCs	3,3'-Dichlorobenzidine	µg/kg	40	0.151	216	9	22.5	83.15	20.1	25000	32	NA	NA
SVOCs	4-Bromophenyl-phenylether	µg/kg	41	361	361	1	2.44	361	14.4	25000	40	NA	NA
SVOCs	4-Chloroaniline	µg/kg	16	220	460	2	12.5	340	430	25000	14	NA	NA
SVOCs	4-Chlorophenyl-phenylether	µg/kg	41	146	146	1	2.44	146	20.9	25000	40	NA	NA
SVOCs	4-Methylphenol	µg/kg	16	290	290	1	6.25	290	430	25000	15	NA	NA
SVOCs	4-Nitrophenol	µg/kg	16	2600	2600	1	6.25	2600	1100	62000	15	NA	NA
SVOCs	Acetophenone	µg/kg	16	39	290	4	25	121	430	25000	12	NA	NA
SVOCs	Azobenzene	µg/kg	23	10.9	30.6	2	8.7	20.75	16.7	408	21	NA	NA
SVOCs	Benzaldehyde	µg/kg	16	43	43	1	6.25	43	430	25000	15	NA	NA
SVOCs	Benzidine	µg/kg	25	119	776	9	36	288.89	31	408	16	NA	NA
SVOCs	Benzo(b)fluoranthene	µg/kg	40	47	3670	35	87.5	1127.06	400	25000	6	NA	NA
SVOCs	Benzo(g,h,i)perylene	µg/kg	40	100	14000	35	87.5	2089.52	400	25000	6	NA	NA
SVOCs	Benzo(k)fluoranthene	µg/kg	41	33	3750	36	87.8	1006.86	400	25000	5	NA	NA
SVOCs	bis(2-Chloroethoxy)methane	µg/kg	41	0.327	55.6	5	12.2	21.51	29.1	25000	36	NA	NA
SVOCs	bis(2-Chloroethyl)ether	µg/kg	41	0.672	1530	9	21.95	351.44	27.9	25000	32	NA	NA
SVOCs	bis(2-Chloroisopropyl)ether	µg/kg	41	9.16	1970	15	36.59	363.06	12.1	25000	26	NA	NA
SVOCs	Butylbenzylphthalate	µg/kg	41	0.578	485	18	43.9	117.29	16.9	25000	23	NA	NA
SVOCs	Carbazole	µg/kg	16	70	200	2	12.5	135	430	25000	14	NA	NA
SVOCs	Dibenzofuran	µg/kg	16	57	3300	3	18.75	1146	430	25000	13	NA	NA
SVOCs	Diethylphthalate	µg/kg	41	0.176	436.2	20	48.78	127.15	17.4	25000	21	NA	NA
SVOCs	Dimethylphthalate	µg/kg	25	5.45	2000	7	28	322.64	16.4	408	18	NA	NA
SVOCs	Di-n-butylphthalate	µg/kg	41	3.88	487	16	39.02	132.34	60.1	25000	25	NA	NA
SVOCs	Di-n-octylphthalate	µg/kg	40	15.3	295	20	50	56.34	14.7	25000	21	NA	NA
SVOCs	Hexachlorobenzene	µg/kg	41	13.8	129000	27	65.85	8046.3	24.9	25000	14	NA	NA
SVOCs	Indeno(1,2,3-cd)pyrene	µg/kg	16	86	3700	11	68.75	1228.73	530	25000	5	NA	NA
SVOCs	n-Nitrosodiphenylamine	µg/kg	16	470	470	1	6.25	470	430	25000	15	NA	NA
SVOCs	Pentachlorophenol	µg/kg	16	3100	3100	1	6.25	3100	1100	62000	15	NA	NA
SVOCs	Phenol	µg/kg	16	67	67	1	6.25	67	430	25000	15	NA	NA
VOCs	1,1-Dichloroethane	µg/kg	41	2	24.1	2	4.88	13.05	1.46	1100	39	NA	NA
VOCs	1,1-Dichloropropene	µg/kg	22	8.1	8.1	1	4.55	8.1	5	100	21	NA	NA
VOCs	1,3,5-Trimethylbenzene	µg/kg	22	46.3	46.3	1	4.55	46.3	5	100	21	NA	NA
VOCs	2-Butanone (MEK)	µg/kg	38	7	45	8	21.05	20.5	13	2000	30	NA	NA

Table 4-1
Summary of Sediment Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
VOCs	4-Isopropyltoluene	µg/kg	22	20.3	20.3	1	4.55	20.3	5	100	21	NA	NA
VOCs	Carbon disulfide	µg/kg	38	8	420	7	18.42	164.86	5	1100	31	NA	NA
VOCs	Cyclohexane	µg/kg	16	2	390	3	18.75	132	13	1100	13	NA	NA
VOCs	Dichloromethane	µg/kg	41	11	11	1	2.44	11	1.86	1100	40	NA	NA
VOCs	Isopropylbenzene	µg/kg	38	6	29000	22	57.89	2466.51	3.65	16	16	NA	NA
VOCs	Methyl cyclohexane	µg/kg	16	3	620	12	75	213.58	13	16	4	NA	NA
VOCs	n-Butylbenzene	µg/kg	22	176	176	1	4.55	176	5	100	21	NA	NA
VOCs	n-Hexane	µg/kg	22	24.9	24.9	1	4.55	24.9	12	400	21	NA	NA
VOCs	n-Propylbenzene	µg/kg	22	66	180	2	9.09	123	5	100	20	NA	NA
VOCs	sec-Butylbenzene	µg/kg	22	10	109	2	9.09	59.5	5	100	20	NA	NA
VOCs	tert-Butylbenzene	µg/kg	22	40.9	108	2	9.09	74.45	5	50	20	NA	NA
VOCs	Trichloroethane	µg/kg	16	1	18	4	25	5.75	13	1100	12	NA	NA
VOCs	Trichlorofluoromethane	µg/kg	38	2	26	4	10.53	13	5	1100	34	NA	NA
VOCs	Vinyl chloride	µg/kg	41	13	13	1	2.44	13	2	1100	40	NA	NA
Chemical detected = NO Benchmark = NO													
Pesticides	alpha-BHC	µg/kg	16	--	--	0	0	--	2.2	310	16	NA	NA
Pesticides	Endosulfan Sulfate	µg/kg	16	--	--	0	0	--	4.1	600	16	NA	NA
Pesticides	Endrin aldehyde	µg/kg	16	--	--	0	0	--	4.3	600	16	NA	NA
Pesticides	Toxaphene	µg/kg	38	--	--	0	0	--	110	35000	38	NA	NA
SVOCs	1,2,4-Trichlorobenzene	µg/kg	38	--	--	0	0	--	5	1100	38	NA	NA
SVOCs	1,2-Diphenylhydrazine	µg/kg	13	--	--	0	0	--	22.6	408	13	NA	NA
SVOCs	2,4,5-Trichlorophenol	µg/kg	16	--	--	0	0	--	1100	62000	16	NA	NA
SVOCs	2,4,6-Trichlorophenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	2,4-Dichlorophenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	2,4-Dimethylphenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	2,4-Dinitrophenol	µg/kg	16	--	--	0	0	--	650	62000	16	NA	NA
SVOCs	2-Chlorophenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	2-Methylphenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	2-Nitroaniline	µg/kg	16	--	--	0	0	--	1100	62000	16	NA	NA
SVOCs	2-Nitrophenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	3-Nitroaniline	µg/kg	16	--	--	0	0	--	1100	62000	16	NA	NA
SVOCs	4,6-Dinitro-2-methylphenol	µg/kg	16	--	--	0	0	--	530	62000	16	NA	NA
SVOCs	4-Chloro-3-methylphenol	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	4-Nitroaniline	µg/kg	16	--	--	0	0	--	1100	62000	16	NA	NA
SVOCs	Atrazine	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	Caprolactam	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	Hexachlorocyclopentadiene	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	Isophorone	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	Nitrobenzene	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	n-Nitroso-di-n-propylamine	µg/kg	16	--	--	0	0	--	430	25000	16	NA	NA
SVOCs	Toxaphene	µg/kg	38	--	--	0	0	--	110	35000	38	NA	NA
VOCs	1,1,1,2-Tetrachloroethane	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	1,1,2-Trichloroethane	µg/kg	41	--	--	0	0	--	1.72	1100	41	NA	NA
VOCs	1,2,3-Trichloropropane	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	1,2-Dibromo-3-chloropropane	µg/kg	38	--	--	0	0	--	5	1100	38	NA	NA
VOCs	1,2-Dibromoethane	µg/kg	16	--	--	0	0	--	13	1100	16	NA	NA
VOCs	1,3-Dichloropropane	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	2,2-Dichloropropane	µg/kg	22	--	--	0	0	--	3.65	100	22	NA	NA
VOCs	2-Chloroethylvinylether	µg/kg	25	--	--	0	0	--	5	100	25	NA	NA
VOCs	2-Chlorotoluene	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	2-Hexanone	µg/kg	38	--	--	0	0	--	13	1100	38	NA	NA

Table 4-1
Summary of Sediment Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
VOCs	4-Chlorotoluene	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	Acrolein	µg/kg	25	--	--	0	0	--	13.47	1000	25	NA	NA
VOCs	Bromobenzene	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	Bromochloromethane	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	Bromodichloromethane	µg/kg	41	--	--	0	0	--	1.76	1100	41	NA	NA
VOCs	Bromomethane	µg/kg	41	--	--	0	0	--	4.63	1100	41	NA	NA
VOCs	Chloroethane	µg/kg	41	--	--	0	0	--	2.13	1100	41	NA	NA
VOCs	cis-1,2-Dichloroethene	µg/kg	38	--	--	0	0	--	5	1100	38	NA	NA
VOCs	cis-1,3-Dichloropropene	µg/kg	41	--	--	0	0	--	1.6	1100	41	NA	NA
VOCs	Dibromochloromethane	µg/kg	41	--	--	0	0	--	1.39	1100	41	NA	NA
VOCs	Dibromomethane	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA
VOCs	Dichlorodifluoromethane	µg/kg	38	--	--	0	0	--	5	1100	38	NA	NA
VOCs	Methyl acetate	µg/kg	16	--	--	0	0	--	13	8700	16	NA	NA
VOCs	Methyltert-butylether	µg/kg	16	--	--	0	0	--	13	1100	16	NA	NA
VOCs	trans-1,2-Dichloroethene	µg/kg	38	--	--	0	0	--	3.65	1100	38	NA	NA
VOCs	trans-1,3-Dichloropropene	µg/kg	41	--	--	0	0	--	1.69	1100	41	NA	NA
VOCs	Trichlorotrifluoroethane	µg/kg	16	--	--	0	0	--	13	1100	16	NA	NA
VOCs	Vinyl Acetate	µg/kg	22	--	--	0	0	--	5	100	22	NA	NA

Note:
NA - Not applicable
a - Based on maximum detected concentration
* HQ calculated using maximum detection limit

Table 4-2
Summary of Sediment Preliminary COPC

Group	Chemical	Basis
Preliminary COPC		
Metals	Arsenic	EB, BP
Metals	Cadmium	EB, BP
Metals	Chromium	EB, BP
Metals	Copper	EB, BP
Metals	Lead	EB, BP
Metals	Mercury	EB, BP
Metals	Nickel	EB, BP
Metals	Selenium	PB
Metals	Silver	EB
Metals	Zinc	EB, BP
PCBs	Aroclor 1016	RC, BP
PCBs	Aroclor 1221	RC, BP
PCBs	Aroclor 1232	RC, BP
PCBs	Aroclor 1242	RC, BP
PCBs	Aroclor 1248	EB, BP
PCBs	Aroclor 1254	RC, BP
PCBs	Aroclor 1260	EB, BP
PCBs	PCB congeners	RC, BP
PCBs	Total PCB Aroclors	EB, BP
Dioxin/Furans	Dioxin/furan congeners	BP
Pesticides	4,4'-DDD	EB, BP
Pesticides	4,4'-DDE	EB, BP
Pesticides	4,4'-DDT	EB, BP
Pesticides	Aldrin	MD, BP
Pesticides	alpha-Chlordane	EB, BP
Pesticides	Endrin	MD, BP
Pesticides	gamma-BHC (Lindane)	EB, BP
Pesticides	beta-BHC	BP
Pesticides	delta-BHC	BP
Pesticides	Endosulfan I	BP
Pesticides	Endosulfan II	BP
Pesticides	gamma-Chlordane	RC, BP
Pesticides	Heptachlor	MD, BP
Pesticides	Methoxychlor	MD, BP
Pesticides	Total Chlordane (a&g; U=1/2; Max RL)	EB, BP
Pesticides	Total DDT (U=1/2; Max RL)	EB, BP
SVOCs	2,6-Dinitrotoluene	MD
SVOCs	2-Methylnaphthalene	EB, BP
SVOCs	Acenaphthene	EB, BP
SVOCs	Acenaphthylene	EB, BP
SVOCs	Anthracene	EB, BP
SVOCs	Benzidine	MD
SVOCs	Benzo(a)anthracene	EB, BP
SVOCs	Benzo(a)pyrene	EB, BP
SVOCs	Benzo(b)fluoranthene	MD, RC, BP
SVOCs	Benzo(g,h,i)perylene	MD, RC, BP
SVOCs	Benzo(k)fluoranthene	MD, RC, BP
SVOCs	bis(2-Chloroisopropyl)ether	MD
SVOCs	bis(2-Ethylhexyl)phthalate	EB

Table 4-2
Summary of Sediment Preliminary COPC

Group	Chemical	Basis
SVOCs	Chrysene	EB, BP
SVOCs	Dibenzo(a,h)anthracene	EB, BP
SVOCs	Dimethylphthalate	MD
SVOCs	Fluoranthene	EB, BP
SVOCs	Fluorene	EB, BP
SVOCs	Hexachlorobenzene	MD, BP
SVOCs	Hexachlorobutadiene	EB, BP
SVOCs	Hexachloroethane	EB, BP
SVOCs	Indeno(1,2,3-cd)pyrene	MD, RC, BP
SVOCs	Naphthalene	EB
SVOCs	Phenanthrene	EB, BP
SVOCs	Pyrene	EB, BP
SVOCs	Total HPAHs (U=1/2; Max RL)	EB, BP
SVOCs	Total LPAHs (U=1/2; Max RL)	EB, BP
SVOCs	Total PAHs (U=1/2; Max RL)	EB, BP
VOCs	1,2-Dichlorobenzene	BP
VOCs	1,3-Dichlorobenzene	EB, BP
VOCs	1,4-Dichlorobenzene	EB, BP
VOCs	Benzene	EB
VOCs	Chlorobenzene	EB
VOCs	Ethylbenzene	EB
VOCs	Toluene	EB
VOCs	Total xylene	EB
Second-Tier Preliminary COPC		
Conventionals	Ammonia	NB
Conventionals	Cyanide	NB
Metals	Aluminum	NB
Metals	Antimony	NB
Metals	Barium	NB
Metals	Beryllium	NB
Metals	Calcium metal	NB
Metals	Cobalt	NB
Metals	Iron	NB
Metals	Magnesium	NB
Metals	Manganese	NB
Metals	Potassium	NB
Metals	Sodium	NB
Metals	Thallium	NB
Metals	Vanadium	NB
Pesticides	Endrin aldehyde	NB
Pesticides	Endrin ketone	NB
SVOCs	1,1'-Biphenyl	NB
SVOCs	4-Chloroaniline	NB
SVOCs	Acetophenone	NB
SVOCs	Azobenzene	NB
SVOCs	Benzaldehyde	NB
SVOCs	Carbazole	NB
SVOCs	Dimethylphthalate	NB
VOCs	1,3,5-Trimethylbenzene	NB
VOCs	2-Butanone (MEK)	NB

Table 4-2
Summary of Sediment Preliminary COPC

Group	Chemical	Basis
VOCs	4-Isopropyltoluene	NB
VOCs	Carbon disulfide	NB
VOCs	Cyclohexane	NB
VOCs	Isopropylbenzene	NB
VOCs	Methyl cyclohexane	NB
VOCs	n-Butylbenzene	NB
VOCs	n-Propylbenzene	NB
VOCs	sec-Butylbenzene	NB
VOCs	tert-Butylbenzene	NB
VOCs	Trichloroethane	NB
VOCs	Trichlorofluoromethane	NB
Chemicals Not Considered COPC		
Pesticides	alpha-BHC	ND
Pesticides	Dieldrin	ND
Pesticides	Endosulfan Sulfate	ND
Pesticides	Heptachlor Epoxide	LMD
Pesticides	Toxaphene	ND
SVOCs	1,2,4-Trichlorobenzene	ND
SVOCs	1,2-Diphenylhydrazine	LFD, LMD
SVOCs	2,4,5-Trichlorophenol	ND
SVOCs	2,4,6-Trichlorophenol	ND
SVOCs	2,4-Dichlorophenol	ND
SVOCs	2,4-Dimethylphenol	LFD, LMD
SVOCs	2,4-Dinitrophenol	ND
SVOCs	2,4-Dinitrotoluene	LMD
SVOCs	2-Chloronaphthalene	LMD
SVOCs	2-Chlorophenol	ND
SVOCs	2-Methylphenol	ND
SVOCs	2-Nitroaniline	ND
SVOCs	2-Nitrophenol	ND
SVOCs	3,3'-Dichlorobenzidine	LMD
SVOCs	3-Nitroaniline	ND
SVOCs	4,6-Dinitro-2-methylphenol	ND
SVOCs	4-Bromophenyl-phenylether	LFD, LMD
SVOCs	4-Chloro-3-methylphenol	ND
SVOCs	4-Chlorophenyl-phenylether	LMD
SVOCs	4-Methylphenol	LFD
SVOCs	4-Nitroaniline	ND
SVOCs	4-Nitrophenol	LFD
SVOCs	Atrazine	ND
SVOCs	bis(2-Chloroethoxy)methane	LMD
SVOCs	bis(2-Chloroethyl)ether	LMD
SVOCs	Butylbenzylphthalate	LMD
SVOCs	Caprolactam	ND
SVOCs	Diethylphthalate	LMD
SVOCs	Di-n-butylphthalate	LMD
SVOCs	Di-n-octylphthalate	LMD
SVOCs	Hexachlorocyclopentadiene	ND
SVOCs	Isophorone	ND
SVOCs	Nitrobenzene	ND

Table 4-2
Summary of Sediment Preliminary COPC

Group	Chemical	Basis
SVOCs	n-Nitroso-di-n-propylamine	ND
SVOCs	n-Nitrosodiphenylamine	LMD
SVOCs	Pentachlorophenol	LFD, LMD
SVOCs	Phenol	LMD
SVOCs	Toxaphene	ND
VOCs	1,1,1,2-Tetrachloroethane	ND
VOCs	1,1,1-Trichloroethane	ND
VOCs	1,1,2,2-Tetrachloroethane	ND
VOCs	1,1,2-Trichloroethane	ND
VOCs	1,1-Dichloroethane	LFD, LMD
VOCs	1,1-Dichloroethene	LB
VOCs	1,1-Dichloropropene	LFD
VOCs	1,2,3-Trichloropropane	ND
VOCs	1,2,4-Trimethylbenzene	LB
VOCs	1,2-Dibromo-3-chloropropane	ND
VOCs	1,2-Dibromoethane	ND
VOCs	1,2-Dichloroethane	LB
VOCs	1,2-Dichloropropane	LB
VOCs	1,3-Dichloropropane	ND
VOCs	2,2-Dichloropropane	ND
VOCs	2-Chloroethylvinylether	ND
VOCs	2-Chlorotoluene	ND
VOCs	2-Hexanone	ND
VOCs	4-Chlorotoluene	ND
VOCs	4-Methyl-2-pentanone (MIBK)	LB
VOCs	Acetone	LB
VOCs	Acrolein	ND
VOCs	Acrylonitrile	ND
VOCs	Bromobenzene	ND
VOCs	Bromochloromethane	ND
VOCs	Bromodichloromethane	ND
VOCs	Bromoform	LB
VOCs	Bromomethane	ND
VOCs	Carbon tetrachloride	LB
VOCs	Chloroethane	FD, LMD
VOCs	Chloroform	LB
VOCs	Chloromethane	LB
VOCs	cis-1,2-Dichloroethene	LFD
VOCs	cis-1,3-Dichloropropene	ND
VOCs	Dibromochloromethane	ND
VOCs	Dibromomethane	ND
VOCs	Dichlorodifluoromethane	ND
VOCs	Dichloromethane	LFD
VOCs	Methyl acetate	ND
VOCs	Methyltert-butylether	ND
VOCs	n-Hexane	LFD
VOCs	Styrene	LB
VOCs	Tetrachloroethene	LB
VOCs	trans-1,2-Dichloroethene	ND
VOCs	trans-1,3-Dichloropropene	ND

Table 4-2
Summary of Sediment Preliminary COPC

Group	Chemical	Basis
VOCs	Trichloroethene	LB
VOCs	Trichlorotrifluoroethane	ND
VOCs	Vinyl Acetate	ND
VOCs	Vinyl chloride	LFD, LMD

Notes:

LFD: Detected infrequently at low concentations and not considered to be site related

EB: Detected concentration exceeds benchmark

LB: Detected concentration (or maximum detection limit if not detected) is less than benchmark

LMD: Low magnitude of detection. Based on 85th percentile for Texas sediments.

MD: Magnitude of detection. Exceeds 85th percentile for Texas sediments (see Table 4-3).

NB: Detected but no benchmark available

ND: Not detected

RC: Related to chemicals exceeding benchmark

BP: Bioaccumulation potential

Table 4-3
Comparison of Detected Concentrations in Sediment with 85th Percentile Concentrations

Group	Chemical	Units	Number of Samples	Maximum Detection	Frequency of Detection (%)	85th percentile[a]	Max Detect to 85th percentile ratio
Pesticides	Aldrin	µg/kg	27	8200	18.52	21	390.5
Pesticides	Endrin	µg/kg	27	1000	33.33	28.7	34.8
Pesticides	Heptachlor	µg/kg	27	1100	22.22	17.5	62.9
Pesticides	Heptachlor Epoxide	µg/kg	64	7.94	18.75	50	0.2
Pesticides	Methoxychlor	µg/kg	27	290	25.93	75	3.9
SVOCs	1,2-Diphenylhydrazine	µg/kg	24	135	4.17	1709	0.1
SVOCs	2,4-Dimethylphenol	µg/kg	27	340	3.7	1950	0.2
SVOCs	2,4-Dinitrotoluene	µg/kg	70	824	17.14	1800	0.5
SVOCs	2,6-Dinitrotoluene	µg/kg	70	23000	24.29	1709	13.5
SVOCs	2-Chloronaphthalene	µg/kg	70	69.7	14.29	1970	0.0
SVOCs	3,3'-Dichlorobenzidine	µg/kg	69	276	23.19	2900	0.1
SVOCs	4-Bromophenyl-phenylether	µg/kg	70	408	4.29	1800	0.2
SVOCs	4-Chlorophenyl-phenylether	µg/kg	70	416	5.71	1800	0.2
SVOCs	Benzidine	µg/kg	43	27000	37.21	4600	5.9
SVOCs	Benzo(b)fluoranthene	µg/kg	69	19900	82.61	1800	11.1
SVOCs	Benzo(g,h,i)perylene	µg/kg	69	14000	84.06	1800	7.8
SVOCs	Benzo(k)fluoranthene	µg/kg	70	11900	82.86	1800	6.6
SVOCs	bis(2-Chloroethoxy)methane	µg/kg	70	920	14.29	1709	0.5
SVOCs	bis(2-Chloroethyl)ether	µg/kg	70	1530	24.29	1709	0.9
SVOCs	bis(2-Chloroisopropyl)ether	µg/kg	70	3320	32.86	1709	1.9
SVOCs	Butylbenzylphthalate	µg/kg	70	643	48.57	1800	0.4
SVOCs	Chrysene	µg/kg	69	20100	88.41	1800	11.2
SVOCs	Dibenzo(a,h)anthracene	µg/kg	70	2040	50	1800	1.1
SVOCs	Diethylphthalate	µg/kg	70	436.2	41.43	1800	0.2
SVOCs	Dimethylphthalate	µg/kg	43	2000	27.91	1709	1.2
SVOCs	Di-n-butylphthalate	µg/kg	70	487	38.57	2800	0.2
SVOCs	Di-n-octylphthalate	µg/kg	69	724	47.83	1800	0.4
SVOCs	Hexachlorobenzene	µg/kg	70	201000	55.71	753	266.9
SVOCs	Indeno(1,2,3-cd)pyrene	µg/kg	27	3700	55.56	1800	2.1
SVOCs	n-Nitrosodiphenylamine	µg/kg	27	470	7.41	1350	0.3
SVOCs	Pentachlorophenol	µg/kg	27	3100	3.7	3850	0.8
SVOCs	Phenol	µg/kg	27	67	7.41	1950	0.0
VOCs	1,1-Dichloroethane	µg/kg	70	24.1	4.29	300	0.1
VOCs	Chloroethane	µg/kg	70	12	1.43	750	0.0
VOCs	Vinyl chloride	µg/kg	70	13	2.86	750	0.0

Note:

a - 85th percentile of observations in SWQM portion of TRACS database. Taken from TCEQ 2003.

Table 4-4
Summary of Surface Water Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
Benchmark = YES													
Metals	Arsenic	µg/L	40	0.93	16.3	30	75	4.55	1	50	10	36	FALSE
Metals	Cadmium	µg/L	42	0.056	0.162	5	11.9	0.1	0.05	7	37	8.8	FALSE
Metals	Chromium	µg/L	43	1.99	6	4	9.3	4.19	1	6	39	50	FALSE
Metals	Copper	µg/L	55	0.66	10.6	46	83.64	3.71	3	6	9	3.1	TRUE
Metals	Lead	µg/L	41	0.058	5.54	25	60.98	1.31	1	20	16	8.1	FALSE
Metals	Mercury	µg/L	27	0	0.52	27	100	0.11			0	0.94	FALSE
Metals	Nickel	µg/L	43	2.24	9.81	21	48.84	4.47	5	17	22	8.2	TRUE
Metals	Selenium	µg/L	59	0.14	1.67	32	54.24	0.64	0.14	33	27	71	FALSE
Metals	Silver	µg/L	42	0.61	0.61	1	2.38	0.61	0.05	8	41	0.2	TRUE
Metals	Zinc	µg/L	43	4.95	51	38	88.37	17.09	4	16	5	81	FALSE
Chemical detected = YES Benchmark = NO													
Conventionals	Ammonia	mg/L	14	0.05	1.31	13	92.86	0.44	0.05	0.05	1	NA	NA
Conventionals	Fluoride	mg/L	8	0.4	0.78	8	100	0.58	--	--	0	NA	NA
Conventionals	Nitrate + Nitrite	mg/L	9	0.99	4.11	9	100	2.04	--	--	0	NA	NA
Conventionals	Nitrate as Nitrogen	mg/L	22	2.31	35	22	100	9.58	--	--	0	NA	NA
Conventionals	Nitrite as Nitrogen	mg/L	4	0.05	0.5	3	75	0.24	0.1	0.1	1	NA	NA
Conventionals	ortho-Phosphate	mg/L	12	0.35	1.07	9	75	0.61	0.12	0.3	3	NA	NA
Conventionals	Phosphorus	mg/L	32	0.38	2.85	32	100	0.93	--	--	0	NA	NA
Conventionals	Sulfate	mg/L	31	96	1550	31	100	904.74	--	--	0	NA	NA
Conventionals	Total Kjeldahl nitrogen	mg/L	32	0.61	4.4	32	100	2.33	--	--	0	NA	NA
Diox/Fur	1,2,3,4,6,7,8-HpCDD	pg/L	2	1.213	1.41	2	100	1.31	--	--	0	NA	NA
Diox/Fur	1,2,3,4,7,8-HxCDF	pg/L	2	0.2	0.242	2	100	0.22	--	--	0	NA	NA
Diox/Fur	1,2,3,7,8-PeCDF	pg/L	2	0.171	0.199	2	100	0.18	--	--	0	NA	NA
Diox/Fur	2,3,7,8-TCDD	pg/L	2	0.098	0.098	1	50	0.1	0.028	0.028	1	NA	NA
Diox/Fur	2,3,7,8-TCDF	pg/L	2	0.499	0.741	2	100	0.62	--	--	0	NA	NA
Diox/Fur	OCDD	pg/L	2	17.094	22.825	2	100	19.96	--	--	0	NA	NA
Diox/Fur	OCDF	pg/L	2	22.792	38.516	2	100	30.65	--	--	0	NA	NA
Diox/Fur	Total D/F TEQ-Bird (U=1/2; max RL)	pg/L	2	0.81	0.97	2	100	0.89	--	--	0	NA	NA
Diox/Fur	Total D/F TEQ-Fish (U=1/2; max RL)	pg/L	2	0.24	0.32	2	100	0.28	--	--	0	NA	NA
Diox/Fur	Total D/F TEQ-Mammal (U=1/2; max RL)	pg/L	2	0.28	0.34	2	100	0.31	--	--	0	NA	NA
Diox/Fur	Total HpCDD	pg/L	2	3.709	3.989	2	100	3.85	--	--	0	NA	NA
Diox/Fur	Total HpCDF	pg/L	2	0.983	1.041	2	100	1.01	--	--	0	NA	NA
Diox/Fur	Total HxCDD	pg/L	2	0.285	0.385	2	100	0.34	--	--	0	NA	NA
Diox/Fur	Total HxCDF	pg/L	2	1.17	1.311	2	100	1.24	--	--	0	NA	NA
Diox/Fur	Total PeCDF	pg/L	2	0.77	1.083	2	100	0.93	--	--	0	NA	NA
Diox/Fur	Total TCDD	pg/L	2	0.271	0.357	2	100	0.31	--	--	0	NA	NA
Diox/Fur	Total TCDF	pg/L	2	2.14	4.558	2	100	3.35	--	--	0	NA	NA
Metals	Aluminum	µg/L	42	4.78	2250	17	40.48	344.54	2	100	25	NA	NA
Metals	Calcium	µg/L	46	153	232000	46	100	134244.63	--	--	0	NA	NA
Metals	Iron	µg/L	20	11.6	1400	11	55	405.65	0.05	10	9	NA	NA
Metals	Magnesium	µg/L	45	306	618000	45	100	227289.47	--	--	0	NA	NA
Metals	Manganese	µg/L	20	11.2	94	20	100	39.47	--	--	0	NA	NA
Metals	Potassium	µg/L	38	3080	206000	38	100	78811.58	--	--	0	NA	NA
Metals	Sodium	µg/L	41	3000	6045000	40	97.56	2428820	500	500	1		
Chemical detected = NO Benchmark = NO													
Conventionals	Sulfide	mg/L	18	--	--	0	0	--	0.1	0.1	18	NA	NA
Diox/Fur	1,2,3,4,6,7,8-HpCDF	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA

Table 4-4
Summary of Surface Water Screening Results for Preliminary COPC

Group	Chemical Name	Units	Number of Samples	Minimum Detect	Maximum Detect	Number of Detects	Frequency of Detection (%)	Average Detection	Minimum Non Detect	Maximum Non Detect	Number of Non Detects	Benchmark Value	Exceeds Benchmark
Diox/Fur	1,2,3,4,7,8,9-HpCDF	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	1,2,3,4,7,8-HxCDD	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	1,2,3,6,7,8-HxCDD	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	1,2,3,6,7,8-HxCDF	pg/L	1	--	--	0	0	--	0.143	0.143	1	NA	NA
Diox/Fur	1,2,3,7,8,9-HxCDD	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	1,2,3,7,8,9-HxCDF	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	1,2,3,7,8-PeCDD	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	2,3,4,6,7,8-HxCDF	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	2,3,4,7,8-PeCDF	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
Diox/Fur	Total PeCDD	pg/L	2	--	--	0	0	--	0.142	0.143	2	NA	NA
TPH	TPH - Oil and grease	mg/L	18	--	--	0	0	--	5	5	18	NA	NA

Table 4-5
Summary of Surface Water Preliminary COPC

Group	Chemical	Basis
Preliminary COPC		
Metals	Copper	EB
Metals	Nickel	EB
Second-Tier Preliminary COPC		
Metals	Aluminum	NC
Metals	Barium	NC
Metals	Calcium	NC
Metals	Iron	NC
Metals	Magnesium	NC
Metals	Manganese	NC
Metals	Mercury	BP
Metals	Selenium	BP
Metals	Potassium	NC
Metals	Sodium	NC
Dioxins	Dioxin/furan congeners	NC
Chemicals Not Considered COPC		
Metals	Arsenic	LB
Metals	Cadmium	LB
Metals	Chromium	LB
Metals	Lead	LB
Metals	Silver	LFD
Metals	Zinc	LB

Note:

LFD: Detected infrequently at low concentations and not considered to be site related.

EB: Detected concentration exceeds benchmark

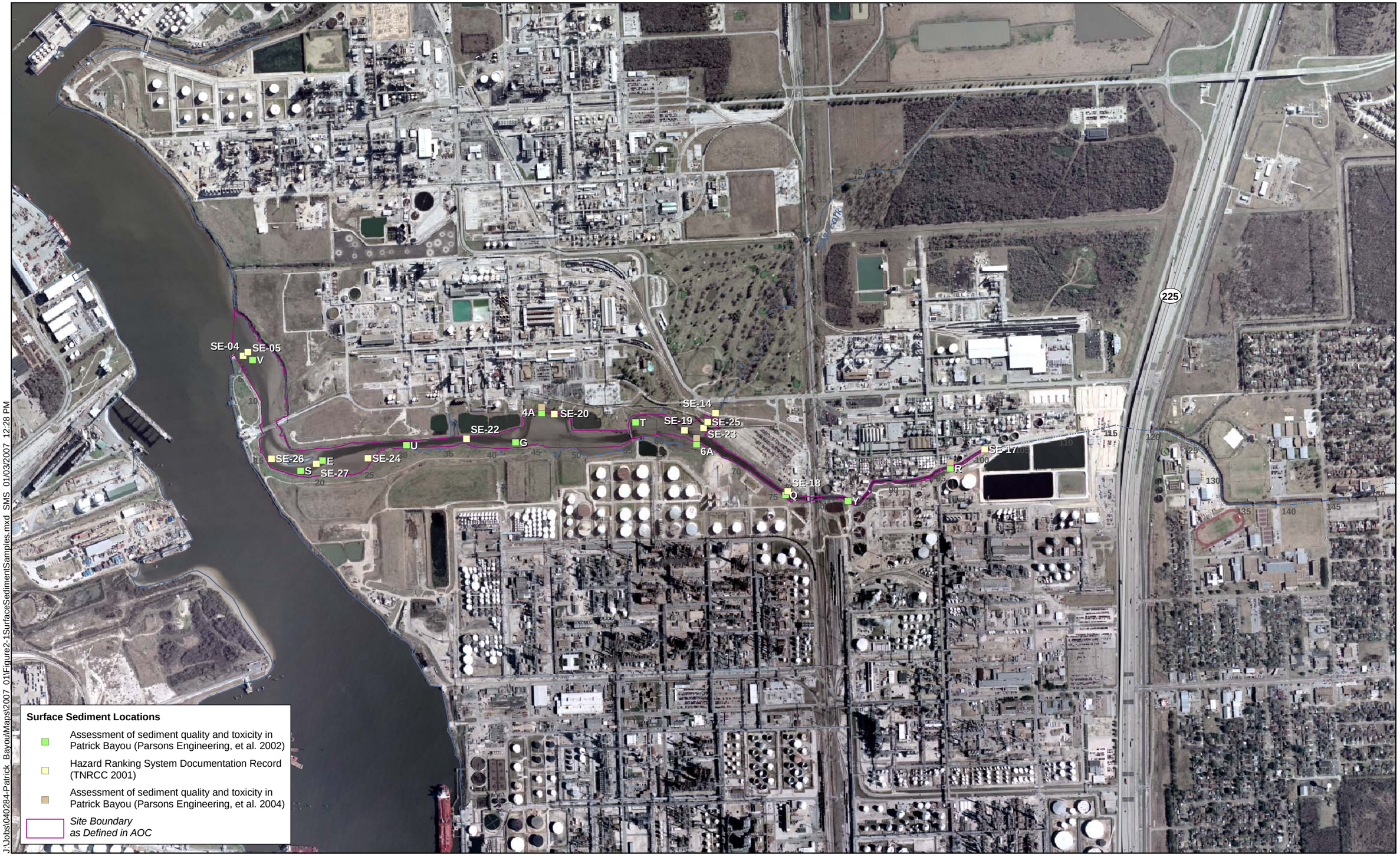
LB: Detected concentration (or maximum detection limit if not detected) is less than benchmark.

LMD: Low magnitude of detection. Based on 85th percentile for Texas sediments.

BP: Bioaccumulation potential

NC: Not considered

FIGURES

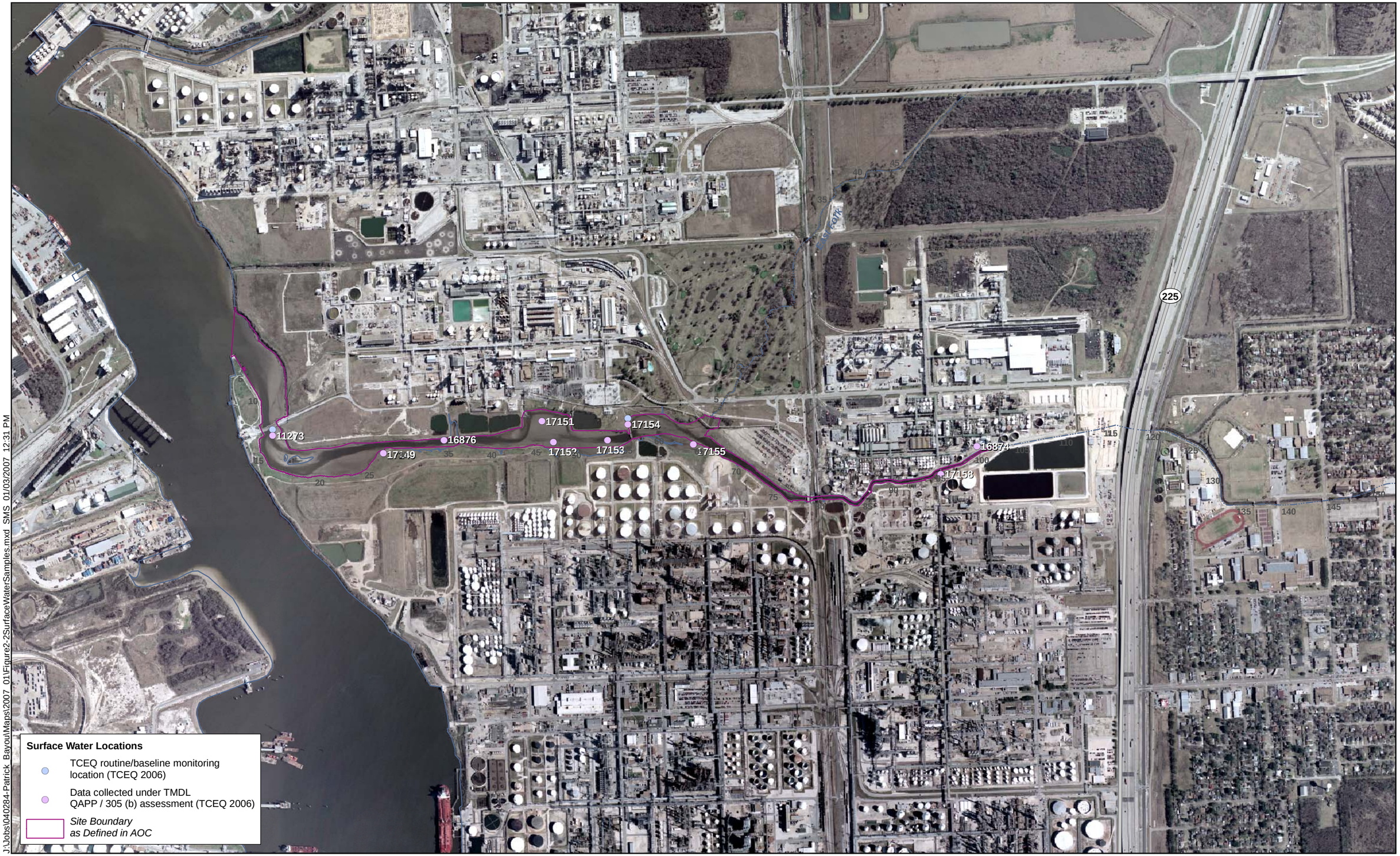


J:\Jobs\040284-Patrick_BayouMaps\2007_01\Figure2-1SurfaceSedimentSamples.mxd SWS 01/03/2007 12:28 PM

ANCHOR ENVIRONMENTAL, L.L.C.

Station numbers from Patrick Bayou PSCR indicate length along channel in hundreds of feet.
Aerial orthoimagery from USGS, June 2002.
Coordinate system NAD 1983 State Plane Texas South Central (feet)

Figure 2-1
Surface Sediment Sample Locations
Patrick Bayou



J:\Jobs\040284-Patrick_Bayou\Maps\2007_01\Figure2-2SurfaceWaterSamples.mxd SMS 01/03/2007 12:31 PM

ANCHOR ENVIRONMENTAL, L.L.C.

0 500 1,000 2,000
Scale in Feet

Station numbers from Patrick Bayou PSCR indicate length along channel in hundreds of feet.
Aerial orthoimagery from USGS, June 2002.
Coordinate system NAD 1983 State Plane Texas South Central (feet)

Figure 2-2
Surface Water Sample Locations
Patrick Bayou